Patent
Attorney's Docket No. 017750-698

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	)	
	)	
Seong-Hwoon Kim et al	)	Group Art Unit: 2817
	)	
Application No.: 10/091,398	)	Examiner: Benny T. Lee
	)	
Filed: March 7, 2002	)	Confirmation No.: 8639
	)	
For: IN-LINE PHASE SHIFTER	)	
	)	
	)	
	)	
	)	

AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action mailed August 12, 2003, please amend the above-identified application as follows:

Patent
Attorney's Docket No. 017750-698

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

Seong-Hwoon KIM et al.

Application No.: ~~09/682,179~~ Should be: 10/091,398

Filed: March 7, 2002

For: INLINE PHASE SHIFTER

Group Art Unit: 2817

Examiner: Benny T. Lee

Confirmation No.: 8639

AMENDMENT/REPLY TRANSMITTAL LETTER

Commissioner for Patents
Alexandria, VA 22313-1450

Sir:

Enclosed is a reply for the above-identified patent application.

[X] A Petition for Extension of Time is also enclosed.

[ ] A Terminal Disclaimer and a check for [ ] $55.00 (2814) [ ] $110.00 (1814) to cover the requisite Government fee are also enclosed.

[ ] Also enclosed is _____

[ ] Small entity status is hereby claimed.

[ ] Applicant(s) request continued examination under 37 C.F.R. § 1.114 and enclose the [ ] $375.00 (2801) [ ] $750.00 (1801) fee due under 37 C.F.R. § 1.17(e).

[ ] Applicant(s) previously submitted __, on __, for which continued examination is requested.

[ ] Applicant(s) request suspension of action by the Office until at least _, which does not exceed three months from the filing of this RCE, in accordance with 37 C.F.R. § 1.103(c). The required fee under 37 C.F.R. § 1.17(i) is enclosed.

[ ] A Request for Entry and Consideration of Submission under 37 C.F.R. § 1.129(a) (146/246) is also enclosed.

[ ] No additional claim fee is required.

[ ] An additional claim fee is required, and is calculated as shown below:

DOCKETED
filed 7/12/03
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AMENDED CLAIMS					
	NO. OF CLAIMS	HIGHEST NO. OF CLAIMS PREVIOUSLY PAID FOR	EXTRA CLAIMS	RATE	ADDT'L FEE
Total Claims	34	MINUS 20 =	14	× $18.00 (1202) =	$ 252.00
Independent Claims	5	MINUS 4 =	1	× $84.00 (1201) =	$ 84.00
If Amendment adds multiple dependent claims, add $280.00 (1203)					
Total Amendment Fee					$ 336.00
If small entity status is claimed, subtract 50% of Total Amendment Fee					
TOTAL ADDITIONAL FEE DUE FOR THIS AMENDMENT					$336.00

[ ] A claim fee in the amount of $ _____ is enclosed.

[X] Charge $ 336.00 to Deposit Account No. 02-4800.

The Commissioner is hereby authorized to charge any appropriate fees under 37 C.F.R. §§ 1.16, 1.17, 1.20(d) and 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 02-4800. This paper is submitted in duplicate.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By: _____
John F. Guay
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P.O. Box 1404
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Date: December 12, 2003

AMENDMENTS TO THE SPECIFICATION:

Please replace paragraph numbers [0018] [0019], [0020] and [0021], beginning on page 4 and ending on page 7, with the following amended paragraphs:

[0018] The first electromechanical means 106, second electromechanical means 108, and a third electromechanical means 110 can be a plurality of electromechanical devices positioned serially along the waveguide path sufficiently adjacent to the waveguide path to change a physical dimension of the waveguide path upon actuation of at least one of the plurality of electromechanical devices. As referenced herein, an electromechanical device is positioned sufficiently adjacent to the waveguide path when it can alter a physical dimension of the waveguide path by any detectable amount. In addition, the fourth electromechanical means 112, fifth electromechanical means 114, and sixth electromechanical means 116 can be another plurality of electromechanical means positioned serially along the waveguide path sufficiently adjacent to the waveguide path to change a physical dimension of the waveguide path upon actuation of at least one of the other plurality of electromechanical devices. Each of the electromechanical means ~~106-116~~ 106, 108, 110, 112, 114, 116 is one of a piezoelectric device, micro-electromechanical device, electrostatic device, or another type of electromechanical device suitable for changing a physical dimension of the waveguide path.

[0019] As shown in the exemplary Fig. 1 embodiment, a plane containing the first electromechanical means 106 and fourth electromechanical means 112 is normal to the waveguide path 104 at point 118 and the planes containing the other sets of electromechanical

means 108/114 and 110/116 are normal to the waveguide path 104 at points 120 and 122, respectively. As referenced herein, "normal" refers to being oriented relative to the path in a manner sufficient to impact the path upon actuation. Each of the electromechanical means ~~106-116~~ 106, 108, 110, 112, 114, 116 respectively has a shutter ~~124-134~~ 124, 126, 128, 130, 132, 134. The upper shutters ~~124-128~~ 124, 126, 128 can descend toward the bottom surface 102b and the lower shutters ~~130-134~~ 130, 132, 134 can ascend toward the top surface 102a. Between each of the shutters (e.g., 124 and 130) of a respective set of electromechanical means (e.g., 106 and 112) there is an opening (e.g., 136) normal to the waveguide path 104 between the shutters (e.g., 124 and 130). The height of the opening (e.g., 136) between respective shutters (e.g., 124 and 130) is dependent upon the amount of actuation that has taken place in their respective electromechanical means (e.g., 106 and 112).

[0020] As shown in Fig. 2, which is a cross-sectional view 200 along line A-A' of the exemplary embodiment 100 in Fig.1, side surfaces of the upper shutters ~~224-228~~ 224, 226, 228 can be electrically connected (directly or indirectly) to the top surface 202a of the waveguide 202 with conductive means, such as spring fingers ~~242-252~~ 242, 244, 246, 248, 250, 252, or any other suitable conductor or semiconductor. Side surfaces of the lower shutters ~~230-234~~ 230, 232, 234 are electrically connected (directly or indirectly) to the bottom surface 202b of the waveguide ~~202a~~ 202 with a set of spring fingers ~~254-264~~ 254, 255, 256, 258, 260, 264. In the alternative, or in addition, electrical connection can be made with, for example, conductive brush like structures. Flexible conductive films can also be attached at

points along the sides of the shutters with enough slack in the film to allow the shutters to move up and down.

[0021] As shown in Fig. 3, which is a cross-sectional view along line B-B' of an exemplary means 110 in Fig.1, the electromechanical means is a piezoelectric device 310 having a shutter 326 that is connected to the central point 366 of a piezoelectric element 368. The ends of the piezoelectric element 368 are attached to the housing 311 of the piezoelectric device 310. The representation of the shutter 326, the central point 366 and the piezoelectric element 368 in solid lines of Fig. 3 is an illustration of an actuated state of the device (e.g., a voltage is being applied across the piezoelectric element 368 by wires at the ends of the piezoelectric element 324). The representation of the shutter 326', the central point 366' and the piezoelectric element 368' in dashed lines is an illustration of an unactuated state of the device (e.g., no voltage is being applied across the piezoelectric element 368'). The magnitude of the voltage applied to the piezoelectric element can be used to determine the amount of movement or actuation that the shutter 326 will undergo, and the final position 370 that the shutter will hold. The shutter 326 can move to, and hold, any position within a range of positions 372 depending upon the voltage applied across the piezoelectric element ~~324~~ 368.

Please replace paragraph number [0023], beginning on page 7 and ending on page 8, with the following amended paragraph:

[0023] The actuation of the shutters ~~424-434~~ 424, 426, 428, 430, 432, 434 into the waveguide 402 changes the physical dimensions of the waveguide path 404, as shown in Fig. 4. For example, the cross-sectional area of the waveguide path 404 at a point B in the opening Ob between the first shutter structure 424 and fourth shutter structure 430 has been reduced. Further along the waveguide path 404 at a point C in the opening Oc between the second shutter structure 426 and the fifth shutter structure 432 the cross-sectional area is further reduced. At point D along the waveguide path 404, the cross-sectional area in the opening Od between the third shutter structure 428 and fourth shutter structure 434 is the same as the cross-sectional area between the first shutter structure 424 and fourth shutter structure 430.

Please replace paragraph numbers [0025], [0026] and [0027], beginning on page 8 and ending on page 10, with the following amended paragraphs:

[0025] As shown in Fig. 4, the admittance ~~Y~~ Yin along the waveguide path 404 can be modeled to use impedance matching techniques of transmission line theory. Each opening Ob, Oc, and Od represents a stub in the transmission line equivalent model. The admittance ~~Y~~ Yin includes components Yb, Yc, Yd, ~~of each stub~~ each of which represents the admittance of a respective stub (i.e., set of shutters) and is a function of the cross-sectional area of an opening~~, and the separations L~~. Separations (i.e., Lbc and Lcd) between openings (i.e., Ob, Oc, and Od) affect how the reflections from ~~these~~ admittances Yb, Yc and Yd combine to yield the overall reflection seen at both ports of the waveguide 402. Since the separations are fixed, the combination of openings is chosen via actuation of shutters so that the desired

amount of phase shift and impedance match is achieved. For example, in Fig. 4, the combined reflection from the two outboard stubs nominally cancels the reflection from the center stub. Symmetry of the stub arrangement reduces losses due to reflection but is not necessary.

[0026] Fig. 5 illustrates an exemplary embodiment 500 of a dynamic inline phase shifter having a waveguide 502 through which a signal travels in one of two directions (e.g. bi-directional) along the waveguide path 504. The waveguide 502 has a first (e.g., top) surface 502a and a second (e.g., bottom) surface 502b that are parallel to each other. Positioned within the waveguide 502 adjacent to and along the top surface are a first electromechanical means 506, a second electromechanical means 508, and a third electromechanical means 510. Positioned within the waveguide 502 adjacent to and along the bottom surface 502b are a fourth electromechanical means 512, a fifth electromechanical means 514, and a sixth electromechanical means 516. The first electromechanical means ~~406~~ 506, second electromechanical means 508 and third electromechanical means 510 are a plurality of electromechanical means positioned serially along the waveguide path 504 sufficiently adjacent to the waveguide path 504 to change a physical dimension of the waveguide path upon actuation of at least one of the electromechanical means. In addition, the fourth electromechanical means 512, fifth electromechanical means 514, and sixth electromechanical means 516 are another plurality of electromechanical means positioned serially along the waveguide path 504 sufficiently adjacent to the waveguide path 504 to change a physical dimension of the waveguide path upon actuation of at least one of the electromechanical means. Each of the electromechanical means ~~506-516~~ 506, 508, 510, 512, 514, 516 is an array

of piezoelectric devices, an array of micro-electromechanical devices, or an array of other types of electromechanical devices suitable for changing a physical dimension of the waveguide path.

[0027] As shown in Fig. 5, each of the arrays ~~506-516~~ 506, 508, 510, 512, 514, 516 has first and second rows of micro-electromechanical devices, respectively shown as x and y in Fig. 5. Each of the micro-electromechanical devices in rows x and y of arrays ~~506-510~~ 506, 508, 510 has a shutter 524. Each of the micro-electromechanical devices in rows x and y of arrays ~~512-516~~ 512, 514, 516 has a shutter 526. The shutters 524 of arrays ~~506-510~~ 506, 508, 510 can move or unroll toward the bottom surface 502b and the shutters 526 of arrays ~~512-516~~ 512, 514, 516 can move or unroll toward the top surface 502a. Each of the micro-electromechanical devices in row x of arrays ~~506-510~~ 506, 508, 510 is connected (directly or indirectly) to the top surface 502a of the waveguide with a conductive strip 530. Each of the micro-electromechanical devices in row x of arrays ~~512-516~~ 512, 514, 516 is connected (directly or indirectly) to the bottom surface 502b of the waveguide with a conductive strip 532.

Please replace paragraph number [0029], beginning on page 10 and ending on page 11, with the following amended paragraph:

[0029] Fig. 6 is a perspective view of a first row exemplary micro-electromechanical device 600x and a second row exemplary micro-electromechanical device 600y on a dielectric

substrate 609 from the exemplary embodiment shown in Fig. 5. The micro-electromechanical devices 600x and 600y respectively include a shutter 624x and 624y mounted on the substrate 609. The shutter 624x is connected to the top or bottom surface of a waveguide (depending if it is in a top or bottom array) by the conductive film 630. The shutters 624x and 624y are respectively mounted above irises 631x and 631y in the substrate 609. Sill electrodes 632x and 632y are respectively mounted below the irises 631x and 631y in the substrate 609. A voltage applied between ~~the~~ a sill electrode ~~632~~ 632x, 632y and ~~the~~ a respective shutter ~~624~~ 624x, 624y of a respective device by wires provides an electrostatic force between the shutter and the sill electrode. The electrostatic force pulls ~~the~~ a shutter ~~624~~ 624x, 624y down over ~~the~~ an iris ~~631~~ 631x, 631y toward ~~the~~ a sill electrode ~~632~~ 632x, 632y of the respective device.

Please replace paragraph numbers [0031], [0032], [0033] and [0034], beginning on page 11 and ending on page 14, with the following amended paragraphs:

[0031] The second row exemplary electromechanical device 600y, as shown in Fig. 6, is not actuated until the shutter 624x of the first row exemplary micro-electromechanical device 600x overlaps or contacts the shutter 624y of the second row exemplary micro-electromechanical device 600y. In general, a subsequent row of an array is not actuated until the row above has been fully actuated if the array is near the top surface or until the row below has been fully actuated if the array is near the bottom surface. A sill insulator can be used to prevent shorts between the sill and the shutter when a shutter is fully actuated. For example, as shown in Fig. 6, the shutter 624x of the first row exemplary micro-electromechanical

device 600x is insulated from the sill electrode 632x by a sill insulator 634x when 624x of the first row exemplary micro-electromechanical device 600x overlaps or comes into contact with the shutter 624y of the second row exemplary micro-electromechanical device 600y. Subsequently, the shutter 624y of the second row exemplary micro-electromechanical device 600y can unroll to and hold a position within a range of positions 635 depending upon the voltage applied between the shutter element 624y ~~of the second row exemplary micro-electromechanical device 600y~~ and the sill electrode 632y. The second row exemplary micro-electromechanical device 600y also may include a sill insulator 634y between the sill electrode 632y and the shutter 624y.

[0032] The description of the micro-electromechanical devices 600x and 600y in Fig. 6 is for electro-mechanical devices in arrays adjacent to the top surface, such as ~~506-510~~ 506, 508, 510 shown in Fig. 5. Micro-electromechanical devices for the arrays adjacent to the bottom surface, such as ~~512-516~~ 512, 514, 516 shown in Fig. 5, can have the shutter mounted on the substrate below the iris in the substrate and the sill electrode mounted above the iris in the substrate. Each row of micro-mechanical devices within each array can have a sill electrode for all of the micro-mechanical devices in a row. Furthermore, the portion of a row x micro-electromechanical device having the coiled portion of shutter can protrude from a surface of the waveguide.

[0033] The embodiment in Fig. 5 can also be represented and modeled as shown in Fig. 3. For example, a first voltage applied to row x of the first array 506, the third array 510, the

fourth array 512 and the sixth array 516 that halfway closes the irises in row x of these respective arrays. The first voltage is also applied to row y of the second array 508 and the fifth array 514 so that the irises in row y of these respective arrays are halfway closed. A second voltage is applied to row x of the second array 508 and the fifth array 514 so that the irises in row ~~y~~ x of these respective arrays are closed. The area of the actuated positions (i.e., area of closed or partially closed iris) for the shutters in the first array 506 can be summed together along with the susceptance of the substrate (which includes any unactuated devices) that the first array 506 is on and thus be collectively seen as the first shutter structure 424 in Fig. 4. Likewise, second array 508 can be seen as the second shutter structure 426, third array 510 can be seen as the third shutter structure 428, fourth array 512 can be seen as the fourth shutter structure 430, fifth array 514 can be seen as the fifth shutter structure 432, and sixth array 516 can be seen as the sixth shutter structure 434.

[0034] To achieve a result comparable to that of the Fig. 4 embodiment, the cross-sectional area of the waveguide path 404 at a point B in the opening Ob between the first shutter structure 424 and fourth shutter structure 430 of Fig. 4 can be substantially equal (i.e., to within ten percent, or more or less) to a summation of the open irises in the first array 506, the fourth array 512, and the opening ~~536~~ 534 between the first and fourth arrays. The cross-sectional area of the waveguide path 404 at point C in the opening Oc between the second shutter structure 426 and the fifth shutter structure 432 of Fig. 4 is less than the cross-sectional area of ~~Fig. 4~~ the waveguide path at point B in the opening Ob, and ~~is less because of the actuation of the shutters in both rows of the second array 508 and fifth array 514. The opening~~

~~Oc between the second shutter structure 426 and fifth shutter structure 432~~ can be substantially equal to a summation of the open irises in the second array 508, the fifth array 514, and the opening 536 between the first and fourth arrays. The cross-sectional area of the waveguide path 404 at point D in the opening Od between the third shutter structure 428 and sixth shutter structure ~~436~~ 434 can be substantially equal to a summation of the open irises in the third array 510, the sixth array 516, and the opening ~~536~~ 538 between the first and fourth arrays. ~~Alternately~~ Alternatively, those skilled in the art will appreciate that each set of arrays can have a unique opening size to tune the sets of arrays for impedance matching purposes. Furthermore, some or all of the arrays can have more or less than two rows of micro-electromechanical devices.

Please replace paragraph number [0036], beginning on page 14 and ending on page 15, with the following amended paragraph:

[0036] Fig. 7 illustrates an exemplary radar system 700 having a plurality of dynamic inline phase shifters ~~701-705~~ 701, 703, 705 connected to a radar transceiver 707. An actuator control circuit 709 is connected to the dynamic inline phase shifters ~~701-705~~ 701, 703, 705 by wiring 711. The actuator control circuit controls the actuation of the electromechanical means in each of the dynamic inline phase shifters ~~701-705~~ 701, 703, 705 and the phase shift of a signal traveling through a dynamic inline phase shifter. Each in line phase shifter can phase shift one of a transmitted 713 and received 715 radar signals. In addition, other types of signals, such as radio signals, can be phase shifted.

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

Claim 1 (currently amended): An inline phase shifter comprising:

a waveguide having at least one electrically conducting surface and a waveguide path; and

at least one electromechanical means for changing a physical dimension of ~~the~~ said electrically conducting surface along the waveguide path to phase shift a signal which travels along the waveguide path.

Claim 2 (original): The inline phase shifter according to claim 1, wherein the electromechanical means is a set of first and second electromechanical devices arranged at a point along the waveguide path and other sets of electromechanical means are positioned at other points along the waveguide path.

Claim 3 (original): The inline phase shifter according to claim 1, comprising:

a first surface of the waveguide parallel to a second surface of the waveguide;

a first electromechanical means positioned adjacent to the first surface; and

a second electromechanical means positioned adjacent to the second surface.

Claim 4 (original): The inline phase shifter according to claim 3, wherein the first electro-mechanical means has a first shutter that can move toward the second surface and the second electro-mechanical means has a second shutter that can move toward the first surface.

Claim 5 (original): The inline phase shifter according to claim 4, wherein there is an opening normal to the waveguide path between the first and second electromechanical devices.

Claim 6 (original): The inline phase shifter according to claim 5, wherein the first and second electromechanical devices are positioned within the waveguide.

Claim 7 (original): A radar system having an inline phase shifter according to claim 1, wherein the inline phase shifter is connected to a radar transceiver for phase shifting one of transmitted and received signals.

Claim 8 (currently amended) A method for phase shifting a signal comprising:

changing physical dimensions of at least one electrically conducting surface along a waveguide path by actuating an electromechanical device; and

inputting a signal along the waveguide path to output a phase shifted signal.

Claim 9 (original): The method for phase shifting a signal according to claim 8, comprising:

sending an actuation signal to the electromechanical device positioned adjacent to a waveguide containing the waveguide path.

Claim 10 (currently amended): An inline phase shifter comprising:

a waveguide having conducting surfaces along a waveguide path of the waveguide; and

a ~~first~~ plurality of electromechanical devices positioned serially along the waveguide path sufficiently adjacent to the waveguide path to change a physical dimension of at least one of the conducting surfaces along the waveguide path upon actuation of at least one of the plurality of electromechanical devices.

Claim 11 (currently amended): ~~The~~ An inline phase shifter ~~according to claim 10,~~ comprising:

a waveguide having a waveguide path; and

a plurality of electromechanical devices positioned serially along the waveguide path sufficiently adjacent to the waveguide path to change a physical dimension of the waveguide path upon actuation of at least one of the plurality of electromechanical devices, wherein the ~~first~~ plurality of electro-mechanical devices is positioned entirely within the waveguide.

Claim 12 (currently amended): An inline phase shifter comprising:

a waveguide having a waveguide path; and

at least one ~~of a~~ micro-electromechanical device ~~and a piezoelectric device~~ positioned sufficiently adjacent to the waveguide path to change a ~~physical dimension of~~ size of an electrically conducting area of the waveguide along the waveguide path upon actuation of the at least one micro-electromechanical device.

Claim 13 (currently amended): The inline phase shifter according to claim 12, ~~comprising:~~ wherein ~~a~~ said waveguide ~~having~~ comprises a first surface and a second surface parallel to the waveguide path~~;~~ and includes a first said micro-electromechanical device positioned adjacent to the first surface~~;~~ and a second said micro-electromechanical device positioned adjacent to the second surface.

Claim 14 (currently amended): The inline phase shifter according to claim 13, wherein the first and second micro-electromechanical devices are a set of devices arranged at a point along the waveguide path, and other sets of devices are positioned at other points along the waveguide path.

Claim 15 (currently amended): The inline phase shifter according to claim 13, wherein the first micro-electromechanical device has a first shutter that can unroll toward the second surface and the second micro-electromechanical device has a second shutter that can unroll toward the first surface.

Claim 16 (original): The inline phase shifter according to claim 15, wherein there is an opening normal to the waveguide path between the first and second shutters.

Claim 17 (currently amended): The inline phase shifter according to claim 13, wherein the first and second micro-electromechanical devices are positioned within the waveguide.

Claim 18 (currently amended): The inline phase shifter according to claim 12, ~~comprising:~~ wherein ~~a~~ said waveguide ~~having~~ comprises:

a first surface and a second surface parallel to the waveguide path;

a first array of said micro-electromechanical devices positioned adjacent to the first surface; and

a second array of said micro-electromechanical devices positioned adjacent to the second surface~~; and~~, wherein devices of the first ~~devices~~ array have ~~first shutters~~ a shutter that can move toward the second surface, and devices of the second ~~devices~~ array have ~~second shutters~~ a shutter that can move toward the first surface.

Claim 19 (currently amended): The inline phase shifter according to claim 18, wherein there is an opening normal to the waveguide path between the first and second arrays of micro-electromechanical devices.

Claim 20 (currently amended): The inline phase shifter according to claim 19, wherein the first and second arrays are a set of said micro-electromechanical devices arranged at a

point along the waveguide path and other sets of said micro-electromechanical devices are respectively positioned at other points along the waveguide path.

Claim 21 (new): The inline phase shifter according to claim 1, wherein said at least one electromechanical means comprises a piezoelectric element.

Claim 22 (new): The inline phase shifter of claim 1, wherein said changing a physical dimension of said electrically conducting surface along the waveguide path comprises changing a dimension of an electrically conducting wall within the waveguide.

Claim 23 (new): The inline phase shifter according to claim 1, wherein said at least one electromechanical means is positioned entirely within the waveguide.

Claim 24 (new): The inline phase shifter according to claim 1, wherein said at least one electromechanical means comprises an electrostatically actuated shutter.

Claim 25 (new): The inline phase shifter according to claim 1, wherein said at least one electromechanical means comprises a micro-electromechanical device.

Claim 26 (new): The inline phase shifter according to claim 10, wherein each of said plurality of electromechanical devices comprises a piezoelectric element.

Claim 27 (new): The inline phase shifter according to claim 10, wherein said change in a physical dimension of at least one of the conducting surfaces comprises a change in a dimension of a electrically conducting wall.

Claim 28 (new): The inline phase shifter according to claim 10, wherein each of said plurality of electromechanical devices is positioned entirely within the waveguide.

Claim 29 (new): The inline phase shifter according to claim 10, wherein each of said plurality of electromechanical devices comprises an electrostatically actuated shutter.

Claim 30 (new): The inline phase shifter according to claim 10, wherein each of said plurality of electromechanical devices comprises a micro-electromechanical device.

Claim 31 (new): The inline phase shifter according to claim 12, wherein said at least one micro-electromechanical device comprises a piezoelectric element.

Claim 32 (new): The inline phase shifter according to claim 12, wherein said change in the electrically conducting area of the waveguide involves a change in a dimension of a conducting wall in the waveguide.

Claim 33 (new): The inline phase shifter according to claim 12, wherein said at least one micro-electromechanical device is positioned entirely within the waveguide.

Claim 34 (new): The inline phase shifter according to claim 12, wherein said at least one micro-electromechanical device comprises an electrostatically actuated shutter.

AMENDMENTS TO THE DRAWINGS:

The attached sheets of drawings includes changes to Figs. 1 and 4. These sheets, which include Fig. 1 and Fig. 4, replace the original sheets including Fig. 1 and Fig 4. In Fig. 1, reference item 126 under reference item 110 has been changed to --128-- to correct a typographical error. (See paragraph [0022].) In Fig. 4, the reference character --400-- has been added, as required by the Examiner on page 3 of the Office Action and described in paragraph [0022] of the Office Action. Also in Fig. 4, "Zin" has been replaced by "Yin" because the figure shows admittance along the waveguide path 404, as described in paragraph [0025] of the specification.

Please replace the original drawing sheets, which include Fig. 1 and Fig. 4, with the new attached sheets including Fig. 1 and Fig.4.

Attachments: Replacement Sheet
Annotated Sheet Showing Changes

REMARKS

Prior to the present response, claims 1-20 were pending. By way of the above amendments, claims 1, 8, 10-15, and 17-20 have been amended, and claims 21-34 have been added. Accordingly, claims 1-34 are currently pending. Favorable reconsideration is respectfully requested.

Independent claim 1 has been amended to recite that the waveguide comprises at least one electrically conducting surface and that the electromechanical means is for changing a physical dimension of each electrically conducting surface along the waveguide path. Independent claim 8 has been amended to recite a step of changing physical dimensions of at least one electrically conducting surface along a waveguide path by actuating an electromechanical device. Amendments to independent claim 10 recite that the waveguide has conducting surfaces along the waveguide path and the change in a physical dimension is a change in the at least one of the conducting surfaces along the waveguide path. Claim 12 has been amended to recite that the micro-electromechanical device is positioned sufficiently adjacent to the waveguide path to change a size of an electrically conducting area of the waveguide along the waveguide path, and to broaden the claim in some respects. Support for the amendments to claims 1, 8, 10 and 12 can be found throughout the specification, for example, in original paragraphs [0020], [0024], [0025], [0027] and [0029], and Figures 1-6.

Dependent claim 11 has been rewritten to include features of original claim 10 and to recite that the plurality of electro-mechanical devices is positioned entirely within the waveguide. Support for this amendment can be found, for example, in Figs. 4-5 and paragraphs [0023] through [0035] of the specification.

New claims 21, 26 and 31 find support in paragraphs [0018], [0021] and [0026] of the specification, in Figs. 3, 5 and 6 and original claim 12, for instance. New claims 22, 27 and 32 are supported, for example, by the description of the exemplary conducting shutter elements starting at paragraph [0019] and throughout the rest of the specification, and in Figs. 1 to 6. Support for new claims 23, 28 and 33 can be found at least in Figs. 4-5 and paragraphs [0023] through [0035] of the specification. Subject matter recited in new claims 24, 29 and 34 is found, for example, in the description of exemplary embodiments at paragraphs [0018] and [0029] of the specification, and in Figs. 5 and 6. Support for new claims 25 and 30 can be found throughout the original disclosure, for example, at paragraphs [0018], [0026] to [0032] and [0034], Figs. 1-6 and original claim 12.

The Objections to the Disclosure

The Office Action, at page 2, includes an objection to the disclosure for containing informalities. It is respectfully submitted that the above amendments to the specification address the concerns expressed in the Office Action.

On page 3 of the Office Action, the Examiner notes that the reference labels Zin, Yb, Yc, and Yd, as depicted in Fig. 4, are not explicitly described in the specification. In response, paragraph [0025] of the specification has been amended to provide explicit description for the admittances Yb, Yc, and Yd shown in Fig. 4. The present response also includes proposed drawing changes in which the item "Zin," as shown in Fig. 4, has been changed to an admittance "Yin." Support for this change is found in original paragraph [0025], which describes an admittance "Y" along the waveguide path 404.

In connection with Fig. 5, the Office Action asserts that items 530 and 532 are not described in the specification. However, it is respectfully submitted that these items are adequately described in the original specification, at paragraph [0027], lines 6-10: "Each of the micro-electromechanical devices in row x of arrays 506-510 is connected (directly or indirectly) to the top surface 502a of the waveguide with *a conductive strip 530*. Each of the micro-electromechanical devices in row x of arrays 512-516 is connected (directly or indirectly) to the bottom surface 502b of the waveguide with *a conductive strip 532*" (emphasis added).

The Office Action also asserts that reference labels 633 and 634y shown in Fig. 6 are not explicitly described in the specification. With respect to reference item 633, Applicants respectfully submit that explicit description for this reference label is provided in the specification in original paragraph [0030], lines 5-7: "The shutter 624x can unroll to and hold a position within *a range of positions 633* depending upon the voltage applied between the shutter element 624x and the sill electrode 632x" (emphasis added). With regard to reference label 634y shown in Fig. 6, the specification has been amended to include the following: "The second row exemplary micro-electromechanical device 600y also may include a sill insulator 634y between the sill electrode 632y and the shutter 624y." Support for this amendment is found, for example, in original Figure 6 and in description in original paragraph [0031], lines 6-8.

The Office Action includes an objection to the drawings because Fig. 4 does not show reference labels "400," "Y" and "L." In response, Applicants submit herewith proposed drawing change to Fig. 4 that includes the reference labels "400" and "Yin." As noted above,

Applicants' proposed changes to Fig. 4 include replacing "Zin" with "Yin" and have amended the reference "Y" to "Yin" in the specification because the original specification describes Fig. 4 as showing admittance along the waveguide path 404. Applicants have removed the reference to "L" in the specification because it is believed that the description in paragraph [0025] of separations between openings refers to the exemplary separations "Lbc" and "Lcd" would render redundant such inclusion of an additional label "L."

It is respectfully submitted that the changes to the specification and proposed changes to the drawings fully address the objections raised in pages 2 to 3 of the Office Action. Accordingly, it is requested that these objections be withdrawn.

The Rejection Under 35 U.S.C. §112, Second Paragraph

The Office Action rejected claims 13-20 under 35 U.S.C. § 112, second paragraph, for allegedly being indefinite. Applicants disagree that claims 13-20 were indefinite, particularly when read in light of the specification. However, to address the concerns on page 3 of the Office Action, claim 22 has been changed. It is believed that these changes have rendered moot the rejection. Applicants respectfully submit that amended claims 13-20 are definite, and thus fully comply with the requirements of Section 112, second paragraph. Accordingly, Applicants request that the rejection be withdrawn.

The Amended Claims Recite Patentable Subject Matter

The Office Action includes rejection under 35 U.S.C. §102(b) of claims 1, 8, 9 and 12 as being anticipated by U.S. Patent No. 4,575,697 to Rao et al., a Section 102(e) rejection of

claims 1, 7, 8, 9 and 12 as being anticipated by Malone et al., and a Section 102(b) rejection of claims 1, 8, 9, 10, 11 and 12 as being anticipated by U.S. Patent No. 2,775,741 to Corbell. To the extent that the Examiner may consider these rejections to apply to amended claims 1, 8, 10, 11 and 12, and hence also to their respective dependent claims, these rejections are respectfully traversed.

Rao et al., Malone et al. and Corbell Do Not Disclose All Claimed Features

Independent claim 1 has been amended to recite that an inline phase shifter comprises a waveguide *having at least one electrically conducting surface* and a waveguide path, and at least one electromechanical means for changing a physical dimension *of the electrically conducting surface along the waveguide path* to phase shift a signal which travels along the waveguide path. In contrast, each of the Rao et al. Malone et al. and Corbell patents fails to anticipate claim 1 because each describe a device that introduces a dielectric material into a waveguide. (See Rao et al., column 2, lines 37-39, column 3, lines 1-2 and lines 34-36; Malone et al., column 2, line 27 and lines 58-61; and Corbell, column 1, lines 42-43 and column 2, lines 25-45.) Hence, the applied documents fail to anticipate claim 1 because they do not disclose the claimed combination of each and every feature.

Similar distinctions are recited in independent claims 8, 10 and 12. For instance, claim 8 is directed to a method for phase shifting a signal that comprises the step of *changing physical dimensions of at least one electrically conducting surface along a waveguide path* by actuating an electromechanical device. Independent claim 10 recites, *inter alia*, a waveguide having conducting surfaces along a waveguide path, and a plurality of electromechanical

devices positioned serially along the waveguide path sufficiently adjacent to the waveguide path *to change a physical dimension of at least one of the conducting surfaces* along the waveguide path. Independent claim 12 recites, *inter alia*, at least one micro-electromechanical device positioned sufficiently adjacent to the waveguide path *to change a size of an electrically conducting area of the waveguide* along the waveguide path. By contrast, none of the Rao et al., Malone et al. and Corbell patents disclose these features because each describe use of only dielectric materials for shifting a phase.

Claim 12 additionally recites that the devices adjacent to the waveguide path are *micro-electromechanical* devices. It is respectfully submitted that the piezoelectric devices of Rao et al. and Malone et al., and Corbell's bulky mechanical means including a jack cannot reasonably be considered micro-electromechanical devices as claimed.

Independent claim 11 is directed to a waveguide having a waveguide path and a plurality of electromechanical devices positioned serially along the waveguide path sufficiently adjacent to the waveguide path to change a physical dimension of the waveguide path upon actuation of at least one of the plurality of electromechanical devices. Claim 11 recites that the plurality of electro-mechanical devices is positioned *entirely* within the waveguide. It is respectfully submitted that none of the applied references disclose this claimed combination of elements.

To the contrary, each of the Rao et al., Malone et al. and Corbell patents disclose that a dielectric member is inserted through a waveguide wall by way of an actuator residing outside a waveguide. For instance, the Corbell patent describes a device in which dielectric probes 38/39 are inserted through openings 46/47 in the waveguide (see Figs. 1-4 and column 2, lines

17-22), the Rao et al. patent discloses inserting a dielectric "fin" 25 through a slot 27 in a waveguide (column 2, lines 37-39), and Malone et al. describes inserting a rectangular dielectric vane 255 into a rectangular gap 274 in a waveguide 202 (column 2, lines 27-31 and lines 64-67, and Figure 2). In each of the applied references, the mechanisms that cause the dielectric material to enter into a waveguide are positioned *outside* the waveguide. (See the jack mechanism 28 of the Corbell patent, the cantilever/clamp 13/15 mechanism of Rao et al., and the actuator 270 of Malone et al.) Hence, none of the patents applied in the Office Action disclose a plurality of electro-mechanical devices positioned *entirely* within the waveguide, as claimed.

For the above reasons, it is respectfully submitted that each of the Rao et al., Malone et al. and Corbell patents fail to anticipate amended claims 1, 8 and 10-12. Claims 2-7, 9 13-20, and new claims 21-34 depend from one of claims 1, 8, 10 and 12, and are therefore patentable for the above reasons. In addition, the features recited in the dependent claims set forth combinations including further points of distinction.

For all the foregoing reasons, Applicants respectfully submit that the present application is in condition for allowance and a notice to that effect is earnestly solicited. Should the Examiner have any questions regarding this response or the application in general, he is urged to contact the undersigned.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

Date: December 12, 2003

By: _____
John F. Guay
Registration No. 47,248

P.O. Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620

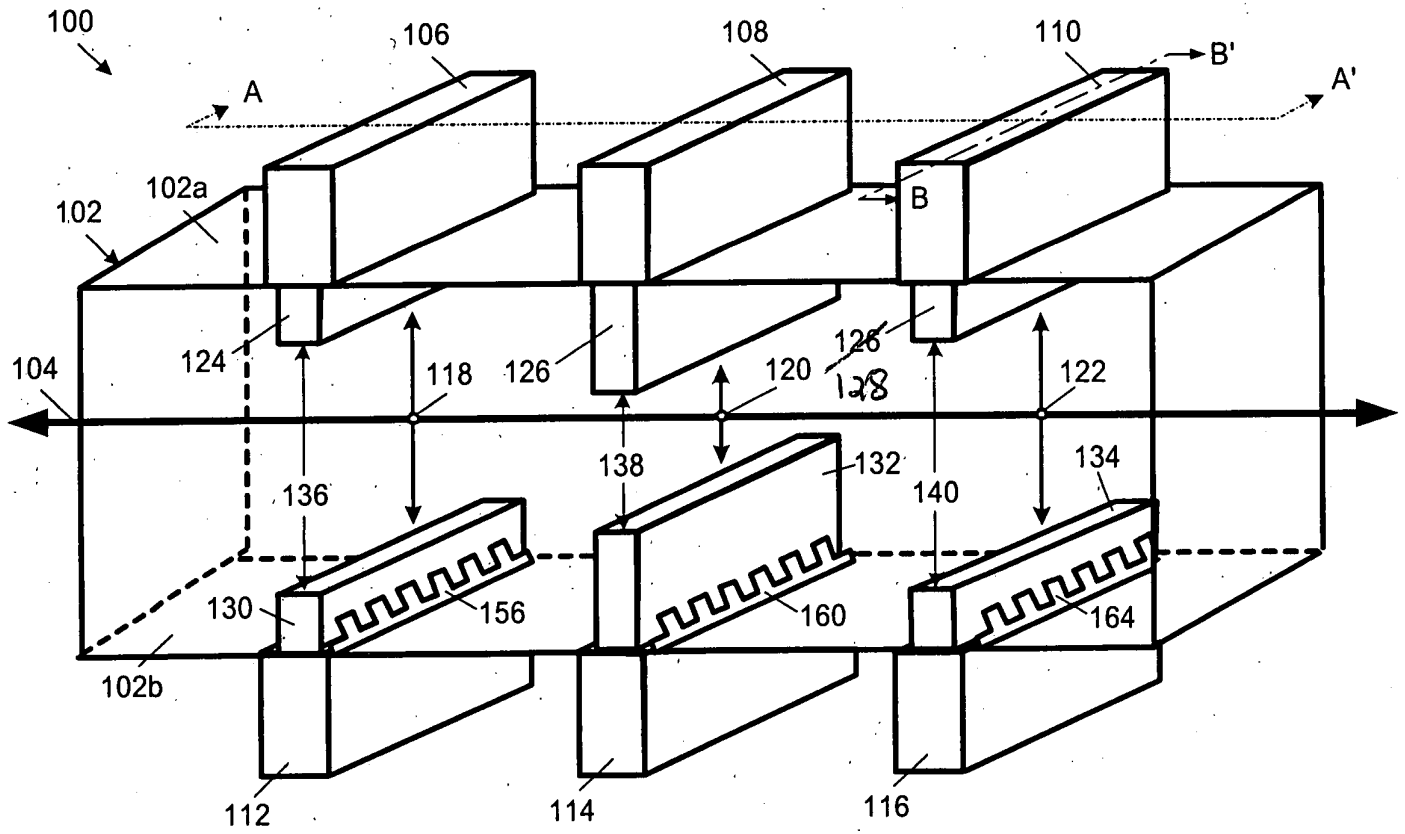

Fig. 1

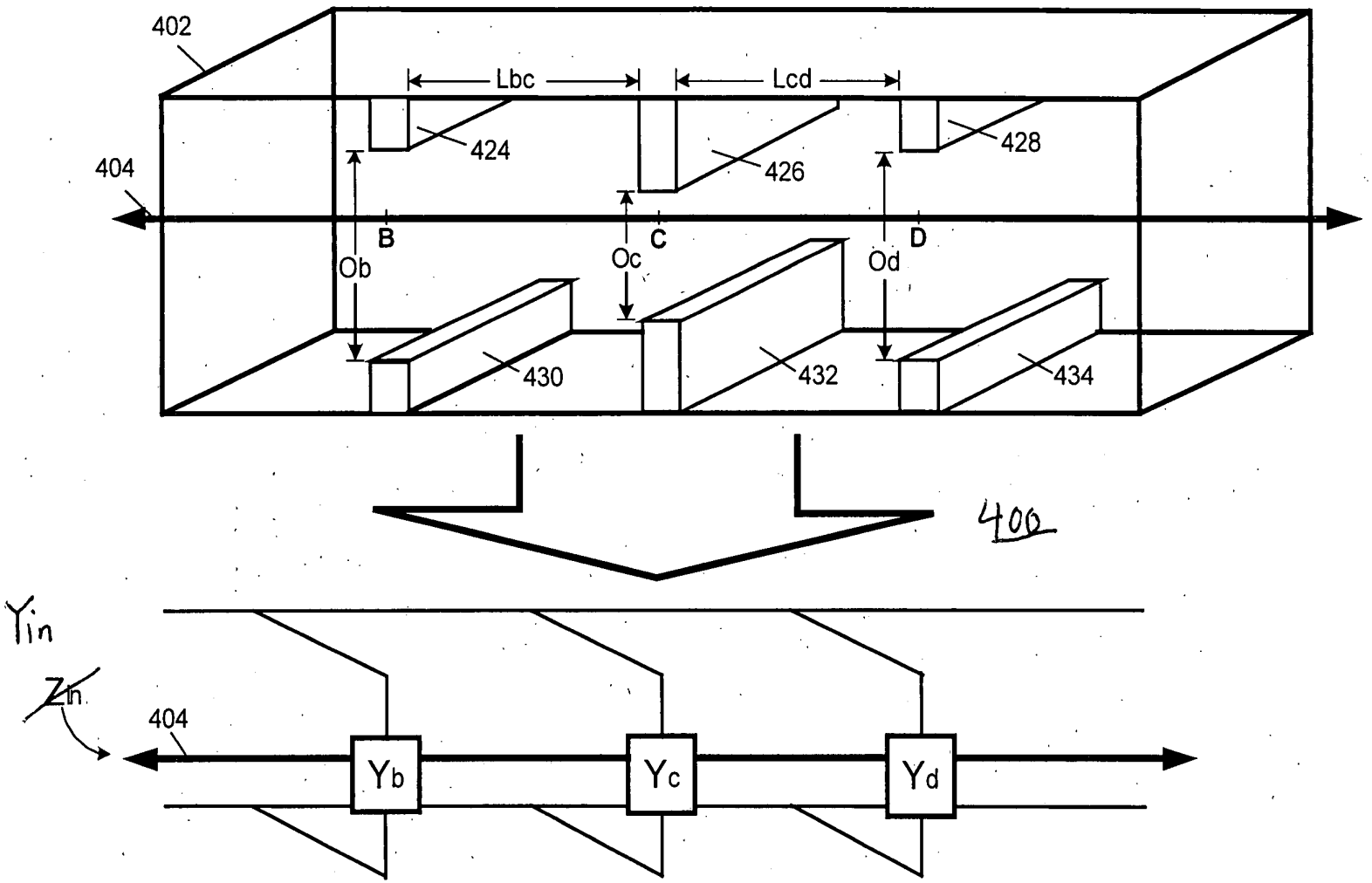

Fig. 4

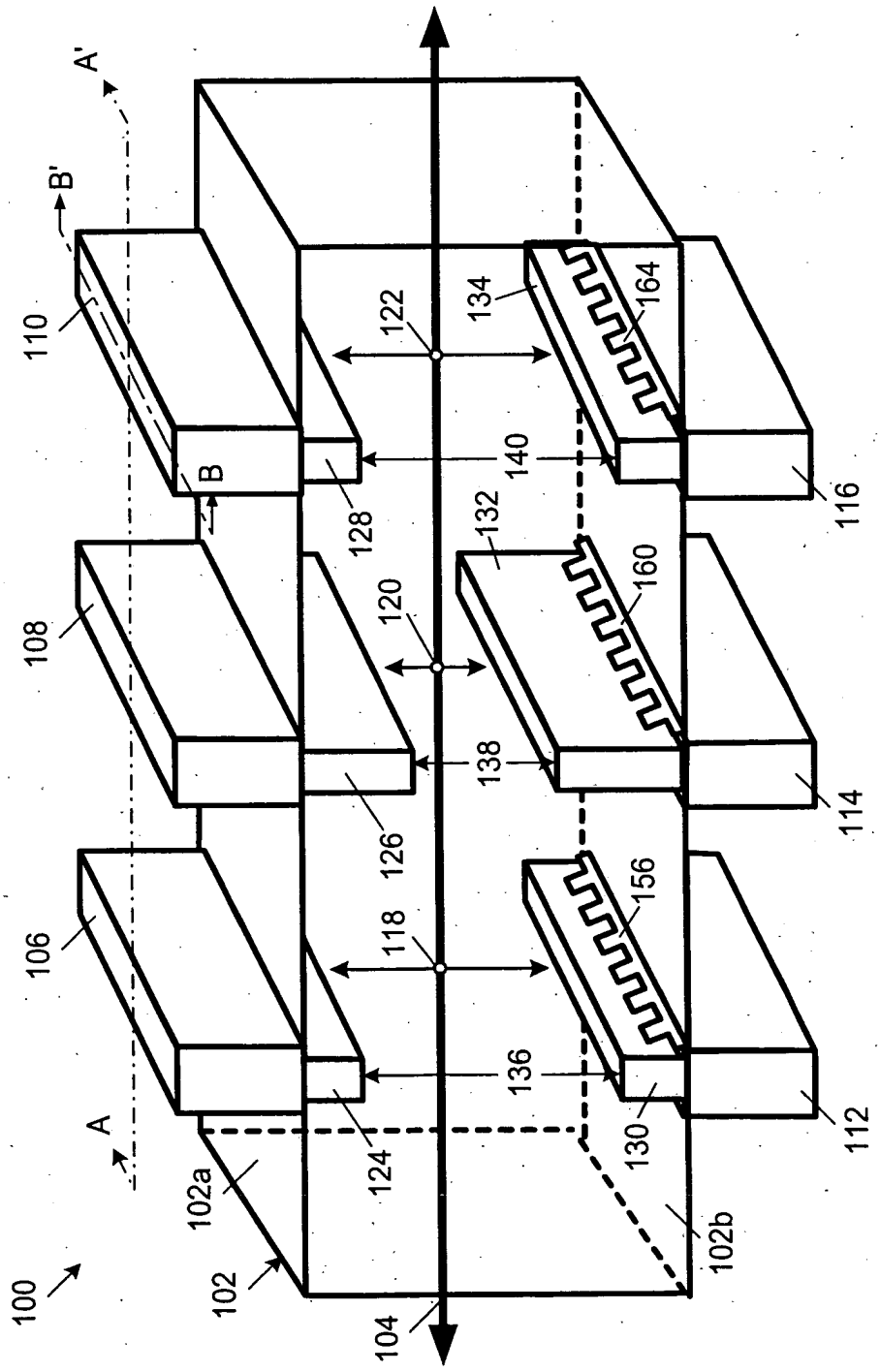

Fig. 1

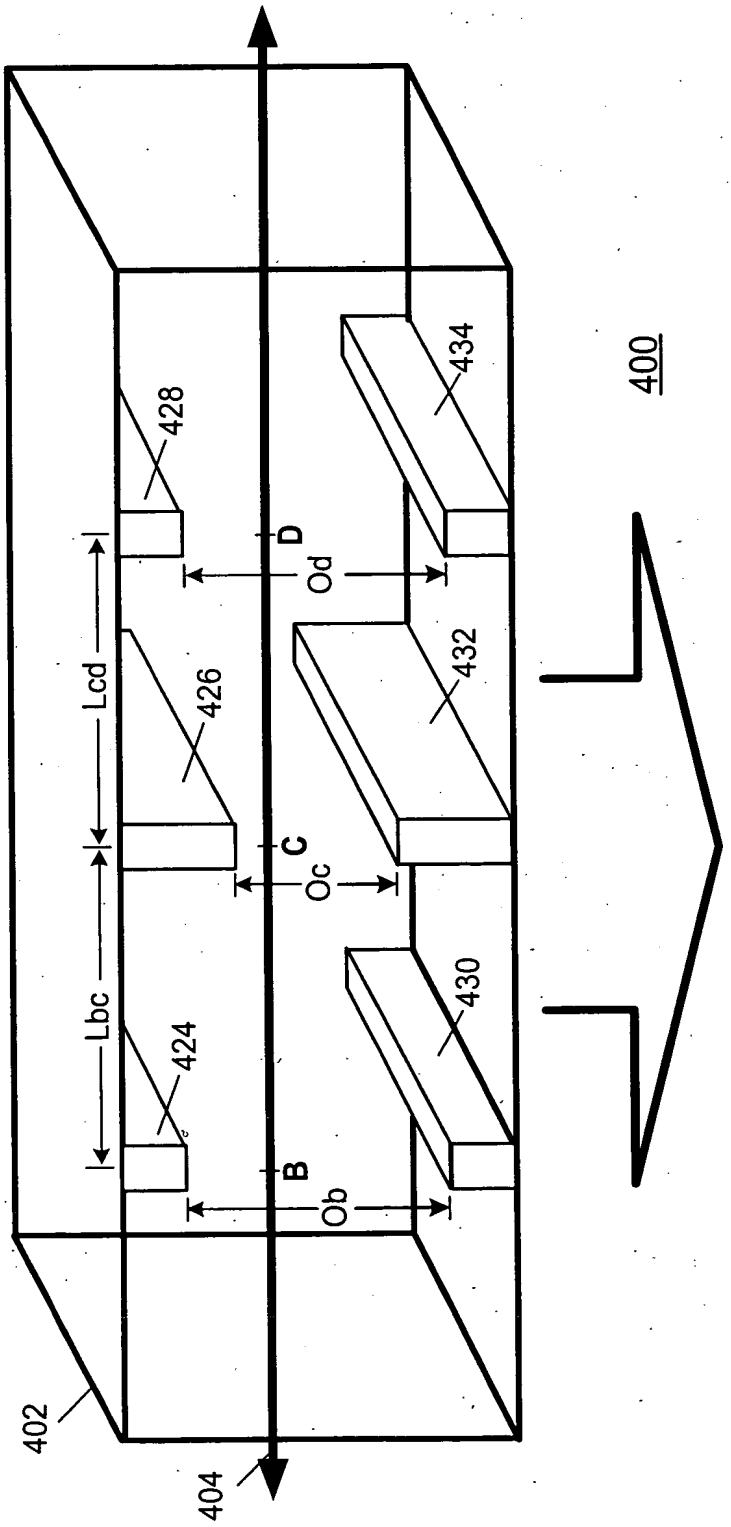

Fig. 4

Patent
Attorney's Docket No. 017750-698

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	
Seong-Hwoon KIM et al.	Group Art Unit: 2817
Application No.: 10/091,398	Examiner: Benny T. Lee
Filed: March 7, 2002	Confirmation No.: 8639
For: INLINE PHASE SHIFTER	

PETITION FOR EXTENSION OF TIME

Commissioner for Patents
Alexandria, VA 22313-1450

Sir:

The following extension of time is requested to extend the period for response to the August 12. 2003 Office Action:

one month to December 12, 2003 ; the extension fee is:

[ ] $55.00 (2251) [X] $110.00 (1251).

[ ] The shortened statutory period has been reset by an Advisory Action dated _____.

[ ] An extension fee in the amount of $ _____ is enclosed.

[X] Charge $ 110.00 to Deposit Account No. 02-4800.

The Commissioner is hereby authorized to charge any appropriate fees under 37 C.F.R. §§ 1.16, 1.17 and 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 02-4800. This paper is submitted in duplicate.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

Date: December 12, 2003

By: _____
John F. Guay
Registration No. 47,248

P.O. Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620

DOCKETED
filed 12/12/03
KJ AL3

IFW 2817

Patent
Attorney's Docket No. 017750-698

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	
Seong-Hwoon KIM et al.	Group Art Unit: 2817
Application No.: 10/091,398	Examiner: Benny T. Lee
Filed: March 7, 2002	Confirmation No.: 8639
For: INLINE PHASE SHIFTER	

REQUEST FOR WITHDRAWAL OF HOLDING OF ABANDONMENT - NO ABANDOMENT IN FACT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In accordance with MPEP § 715.03, withdrawal of the holding of abandonment in the above-captioned application is respectfully requested, there being no abandonment in fact. Specifically, the Notice of Abandonment issued on May 18, 2004, states that the application is held abandoned for failure to respond to the Patent and Trademark Office communication dated August 12, 2003.

However, a reply to that communication was timely filed on December 12, 2003, along with a one-month extension of time. A copy of that reply (i.e., (1) an Amendment Transmittal Letter, (2) an Amendment, and (3) a Petition for Extension of Time for one month until December 12, 2003) is enclosed, as is a postcard receipt date-stamped by the Patent and Trademark Office acknowledging receipt of said reply on said date. This date-stamped postcard receipt, which itemizes and properly identifies the papers filed, is *prima facie* evidence of receipt in the Patent and Trademark Office of all the items listed thereon on the date stamped thereon by the Patent and Trademark Office. See MPEP § 503.

It is noted that the as-filed Transmittal Letter included an error in the application number. However, every other paper filed with the reply (i.e., the Amendment and Petition for Extension of Time) included the correct application number, as did the second page of the

Transmittal Letter. It is respectfully submitted that this error should not have caused the reply not to be entered, and the application to become abandoned, because the correct application number of 10/091,398 was listed on both the Amendment and the Petition for Extension of Time filed with the Transmittal Letter. Furthermore, verification of the application number could have been easily obtained from the confirmation number provided on all papers, the inventor's name, and/or the invention title.

In light of the above, withdrawal of the holding of abandonment and prompt favorable action on the merits is respectfully requested.

It is requested that this paper be treated as a Petition under 37 C.F.R. § 1.181(a), if necessary. It is believed that no fee is required for consideration of this paper. Should the Office deem otherwise, the Director is hereby authorized to charge any appropriate fees under 37 C.F.R. § 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 02-4800. This paper is submitted in duplicate.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

Date: July 15, 2004

By: _____
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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/091,398	03/07/2002	Seong-Hwoon Kim	017750-698	8639

7590 05/18/2004

Patrick C. Keane
BURNS, DOANE, SWECKER & MATHIS, L.L.P.
P.O. Box 1404
Alexandria, VA 22313-1404

EXAMINER
LEE, BENNY T

ART UNIT	PAPER NUMBER
2817	

DATE MAILED: 05/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

URGENT

PCR/JPG

Petition to Revive
8/18/04

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

10/091,398

APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.

EXAMINER	
ART UNIT	PAPER NUMBER
	7

DATE MAILED:

NOTICE OF ABANDONMENT

This application is abandoned in view of:

☑ Applicant's failure to timely file a proper reply to the Office letter mailed on 12 Aug. 2003.

☐ A reply (with a Certificate of Mailing or Transmission of _____) was received on _____, which is after the expiration of the period for reply (including a total extension of time of ____ month(s)) which expired on _____.

☐ A proposed reply was received on _____, but it does not constitute a proper reply under 37 CFR 1.113 to the final rejection.
(A proper reply under 37 CRF 1.113 to a final rejection consists only of: (1) a timely filed amendment which places the application in condition for allowance; (2) a timely filed Notice of Appeal (with appeal fee); or (3) a timely filed Request for Continued Examination (RCE) in compliance with 37 CFR 1.114).

☑ No reply has been received.

☐ Applicant's failure to timely pay the required issue fee and publication fee, if applicable, within the statutory period of three months from the mailing date of the Notice of Allowance (PTOL-85).

☐ The issue fee and publication fee, if applicable, was received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the statutory period for payment of the issue fee (and publication fee) set in the Notice of Allowance.

☐ The submitted fee of $ _____ is insufficient. A balance of $ _____ is due.
The issue fee required by 37 CFR 1.18 is $ _____. The publication fee, if required by 37 CFR 1.18(d), is $ _____.

☐ The issue fee and publication fee, if applicable, has not been received.

☐ Applicant's failure to timely file new formal drawings as required by, and within the three-month period set in, the Notice of Allowability (PTOL-37).

☐ Proposed new formal drawings were received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the period for reply.

☐ The proposed new formal drawings filed on _____ are not acceptable and the period for reply has expired.

☐ No proposed new formal drawings have been received.

☐ The letter of express abandonment which is signed by the attorney or agent of record, the assignee of the entire interest, or all of the applicants.

☐ The letter of express abandonment which is signed by an attorney or agent (acting in a representative capacity under 37 CFR 1.34(a)) upon the filing of a continuing application.

☐ The decision by the Board of Patent Appeals and Interferences rendered on _____ and because the period for seeking court review of the decision has expired and there are no allowed claims.

☐ The reason(s) below:

Beverly M. Lee
SPE LEE
PRIMARY EXAMINER
UNIT 2817

SN 91398

*U.S. GPO: 2000-472-999/43202

BEST AVAILABLE COPY

Inventor: Kenichi SAWADA et al. Appln. No. 10/091,398 Filing Date: March 7, 2002

Docket No.: 017750-698 Work Atty: JFG Date: December 12, 2003

☐ The following was/were received in the U.S. Patent and Trademark Office on the date stamped hereon:

- ☒ Amendment
- ☐ Preliminary Amendment
- ☒ Reply Transmittal Letter
- ☒ Petition for 1 Month Extension of Time
- ☐ Submission of Formal Drawings w/ _ sheet(s) of drawings (Fig(s). 1-_)
- ☐ Request for Approval of Drawing Changes w/ _ sheet(s) of red ink drawings
- ☐ Notice of Appeal
- ☐ Brief for Appellant
- ☐ Request for Oral Hearing
- ☐ Reply Brief
- ☐ Response to Restriction Requirement or Election of Species
- ☐ Terminal Disclaimer
- ☐ Certificate Under 37 C.F.R. § 3.73(b)
- ☐ Transmittal Letter for Missing Parts of Application
- ☐ Executed Declaration/Power of Attorney
- ☐ Assignment/Assignment Recordation Form Cover Sheet (PTO-1595)
- ☐ Claim for Convention Priority w/_ certified copy(s)
- ☐ Information Disclosure Statement w/_ document(s)
- ☐ Information Disclosure Citation (PTO-1449)
- ☐ Information Disclosure Statement Transmittal Letter
- ☐ Request for Corrected Notice of Recordation of Assignment w/copy of Notice
- ☐ Request for Continued Examination
- ☐ Check for $__ is enclosed
- ☐ Check for $__ is enclosed
- ☒ Charge $ 446.00 to Deposit Account
- ☐ Issue Fee Transmittal
- ☐ Payment of Issue Fee and Authorization to charge Deposit Account
- ☐ Request for Refund
- ☐ Status Inquiry
- ☐ Request for Corrected Filing Receipt w/copy of Official Filing Receipt
- ☐
- ☐
- ☐

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